

Lake Source Cooling at Cornell

Innovative Energy Systems Workshop

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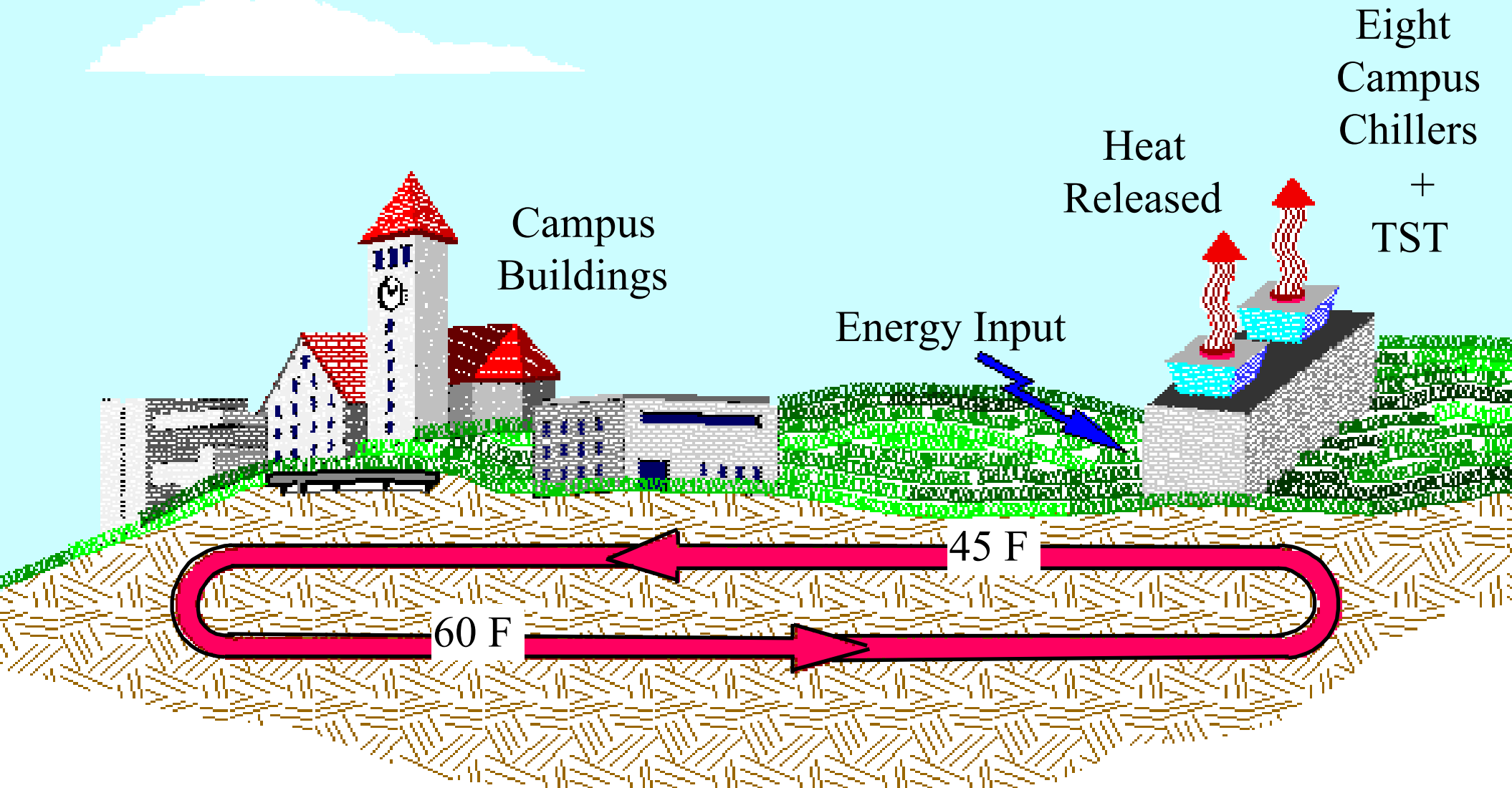
Presentation Outline

- why Lake Source Cooling
- LSC description
- review and approval process
- economics and risk

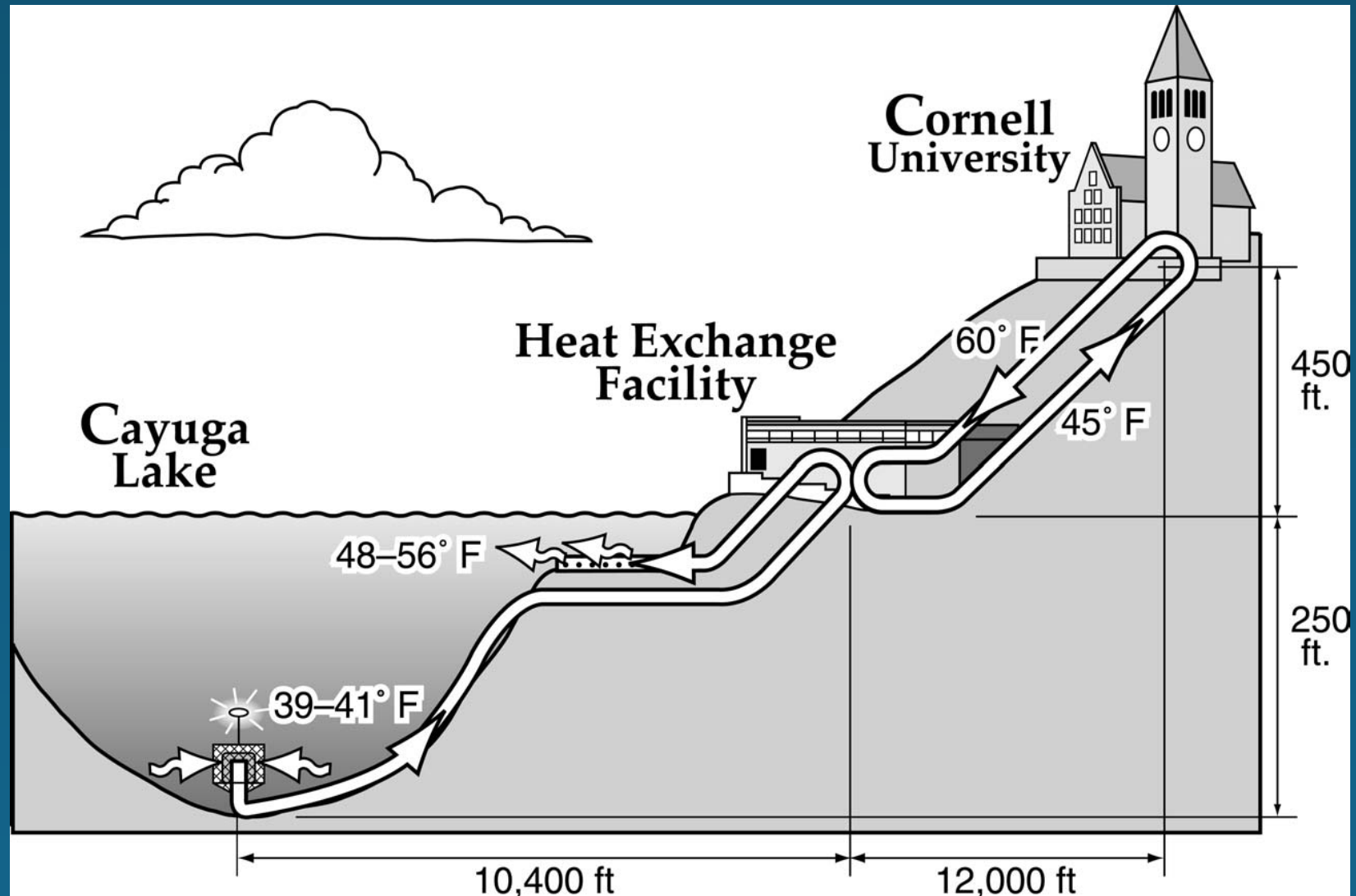
Why Cornell Chose Lake Source Cooling

- accelerated phase-out of chlorofluorocarbons (CFCs)
- renewable resource
- energy efficiency
 - 80% energy savings
- decreased reliance on fossil fuels
 - reduced air pollution, acid rain, global warming
- cost-effectiveness over the long term
- community benefits

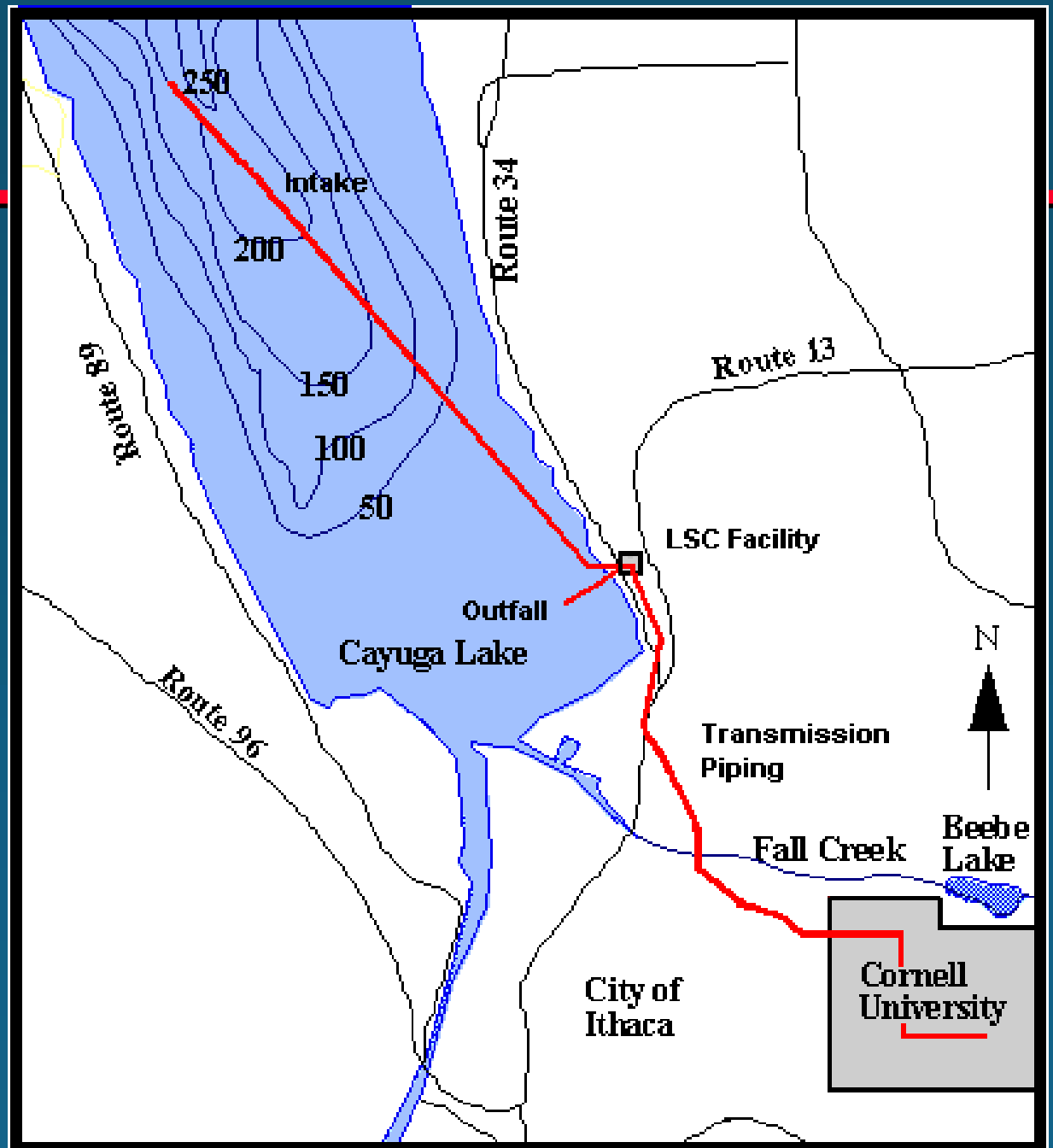
The Cornell Chilled Water System



The Lake Source Cooling Process



Cornell and Cayuga Lake



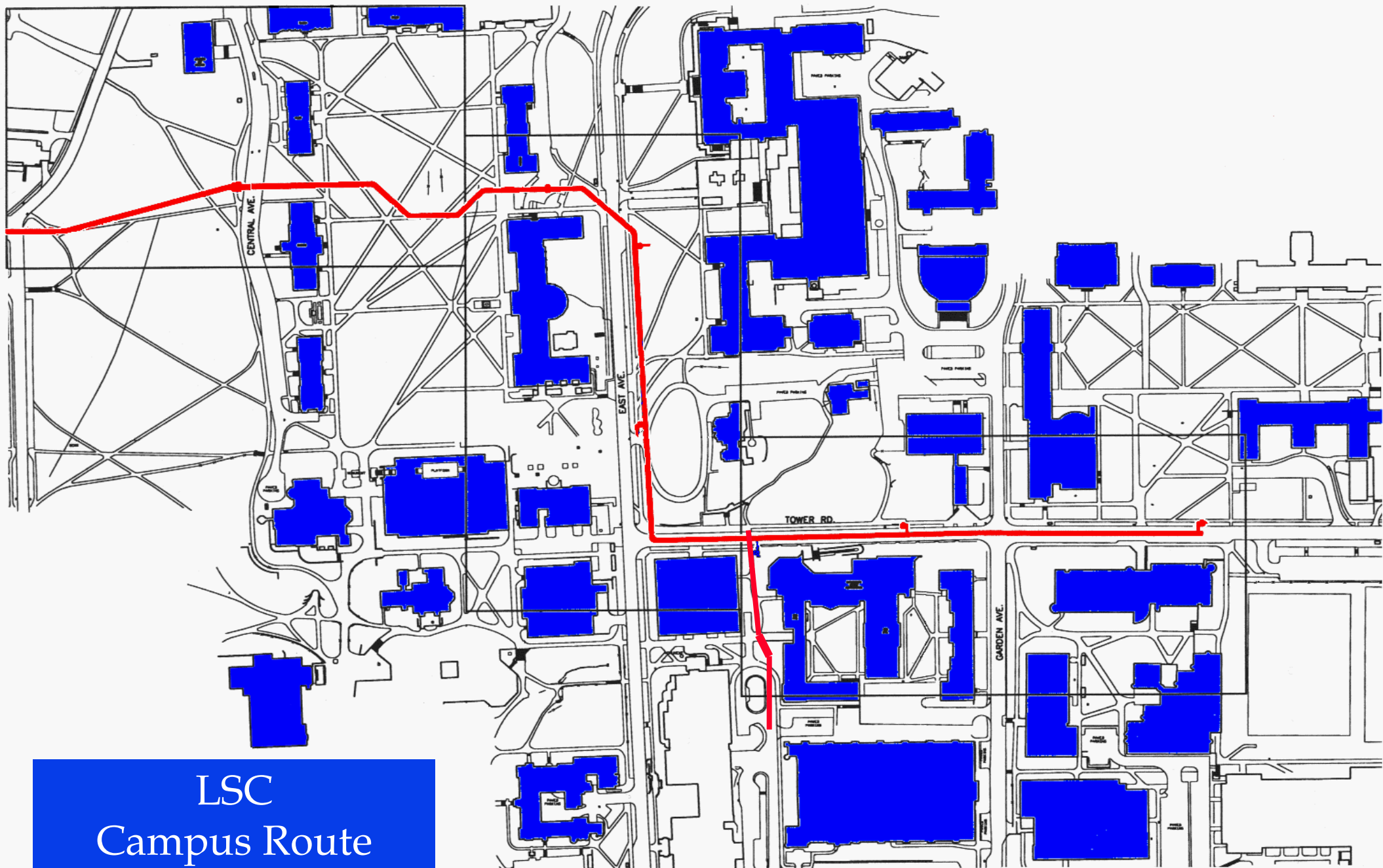
Chilled Water Transmission Route

12,000 trench feet
in 1999

2@42" welded steel

3-layer coating and
cathodic protection





LSC
Campus Route

Chilled Water Pipe Installation on Libe Slope



Lake Source Cooling Aerial View



Marine Pipe Unloading



LSC Tran. Rt.

4/8/1999

63" Intake Pipe After Fusing



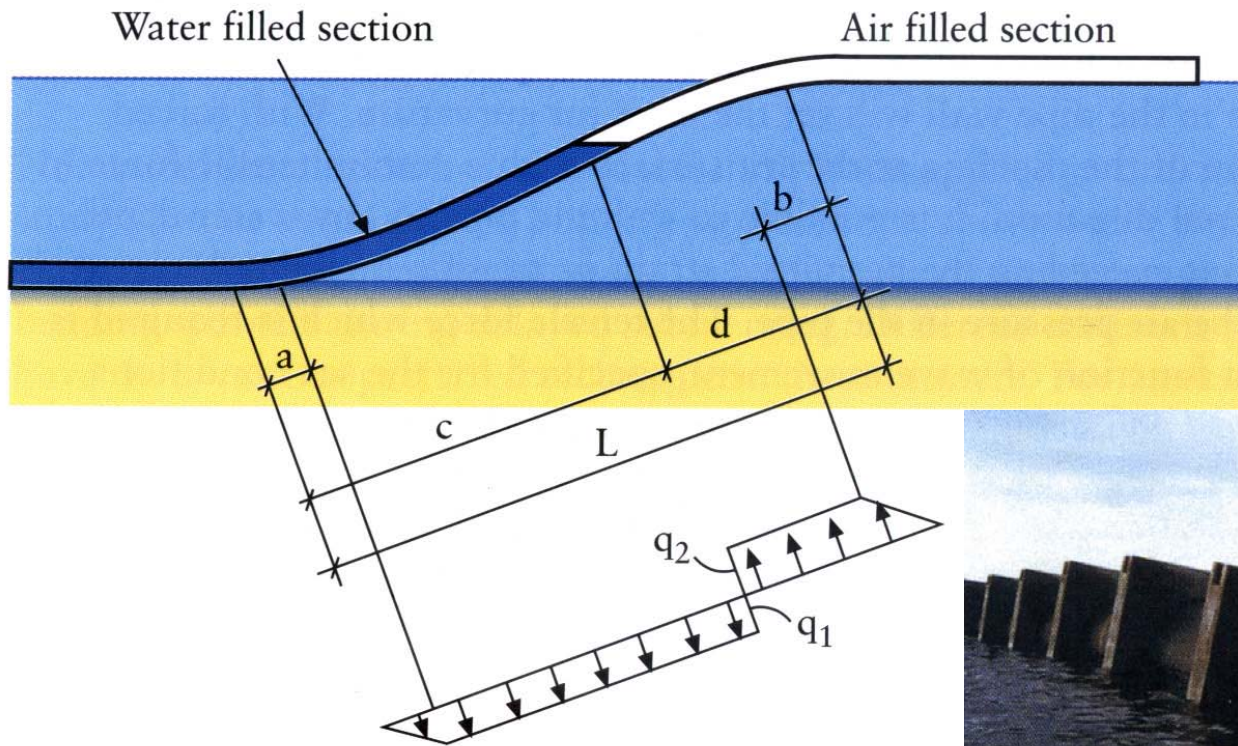
LSC Marine

7/8/1999

Pipes in the Mooring Area



Lake Piping Installation - Sinking



Positioning the Intake



Splicing Segments Together

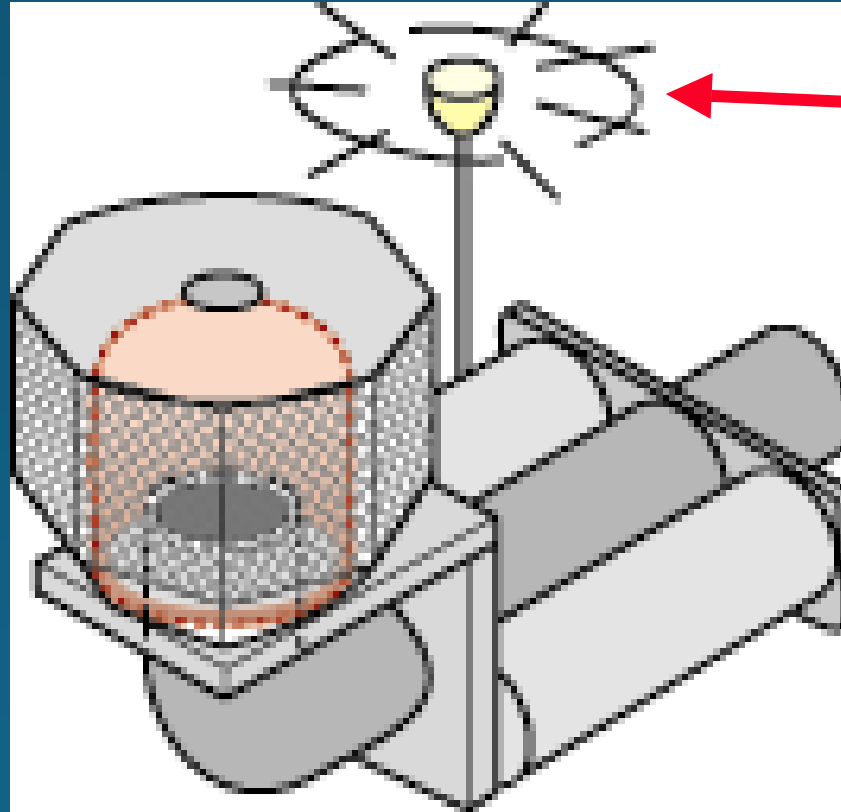


Controlled Sinking



Intake Structure at 250 feet

Intake screen to
keep out fish



Low wattage light
to repel mysid
shrimp

Intake ready for sinking



Intake Screen



University review and approval

- master planning
- unusual projects require new methods
- scientific and engineering oversight and review
- faculty involvement
- advisory group of officers of the corporation
- advisory group of trustees
- peer consultant review

Benefits to the Community

- Ithaca High School cooling savings of \$750,000
- new sidewalks, roads and utilities of \$1.5 million for City of Ithaca
- greater employment for construction
- construction services worth \$20 million
- purchase of construction supplies worth \$3 - 4 million
- new lake shore park for the Town of Ithaca, a first
- bonding fees

Pro LSC Letters to the I.J.

- “I support LSC...This vibrant skepticism, this tendency to debate any and all issues, is one of Ithaca’s most endearing characteristics, at least to the point where common sense and knowledge give way to bias, a willingness to win at any cost, and a disregard for evidence.” CU Prof. Oglesby (11/98)

Con letters to the IJ

- “local officials have not acted in the interest of the community” in announcing law suit. CLDF (9/98)
- “LSC is another not well thought out idea by Cornell”
Ralph Nader (9/98)

Permits and Reviews Required

- Federal

wetlands

endangered species

- State

water discharge (SPDES & stormwater)

historical preservation review

department of transportation

- Town, City, County

unique natural area review

site plan review for building permit

zoning amendment

street permit

recreational river permit

Risks and Issues Understood

- Electric and construction costs
 - Economic analysis
- 17 permits and approvals
- DEC and the Environmental Impact Statement
- Community reaction
- Easements and real estate needs

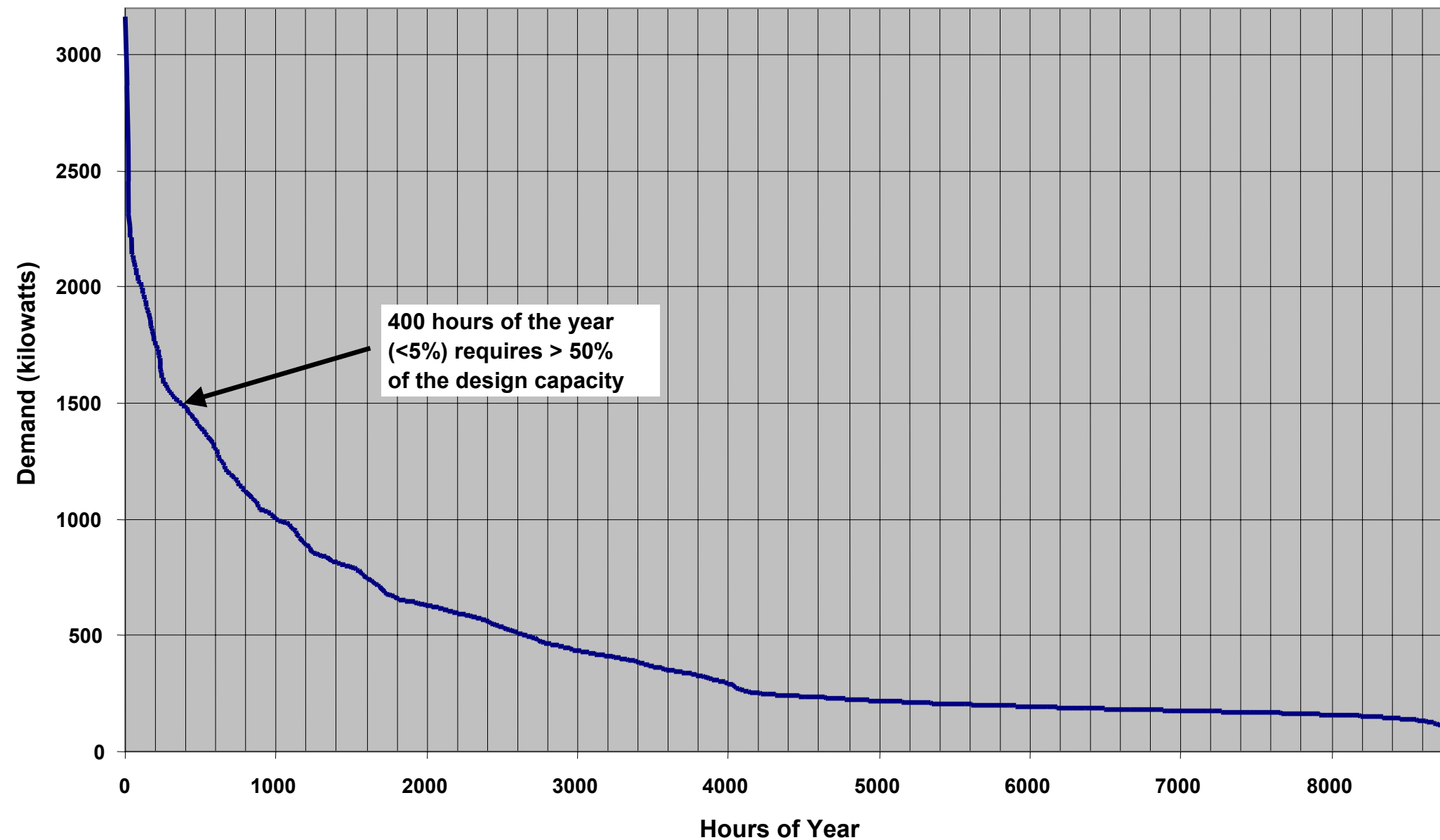
Proforma Development

- engineering model
- assumptions about the future
- economic model
- sensitivity analysis

How do we deal with unknowns?



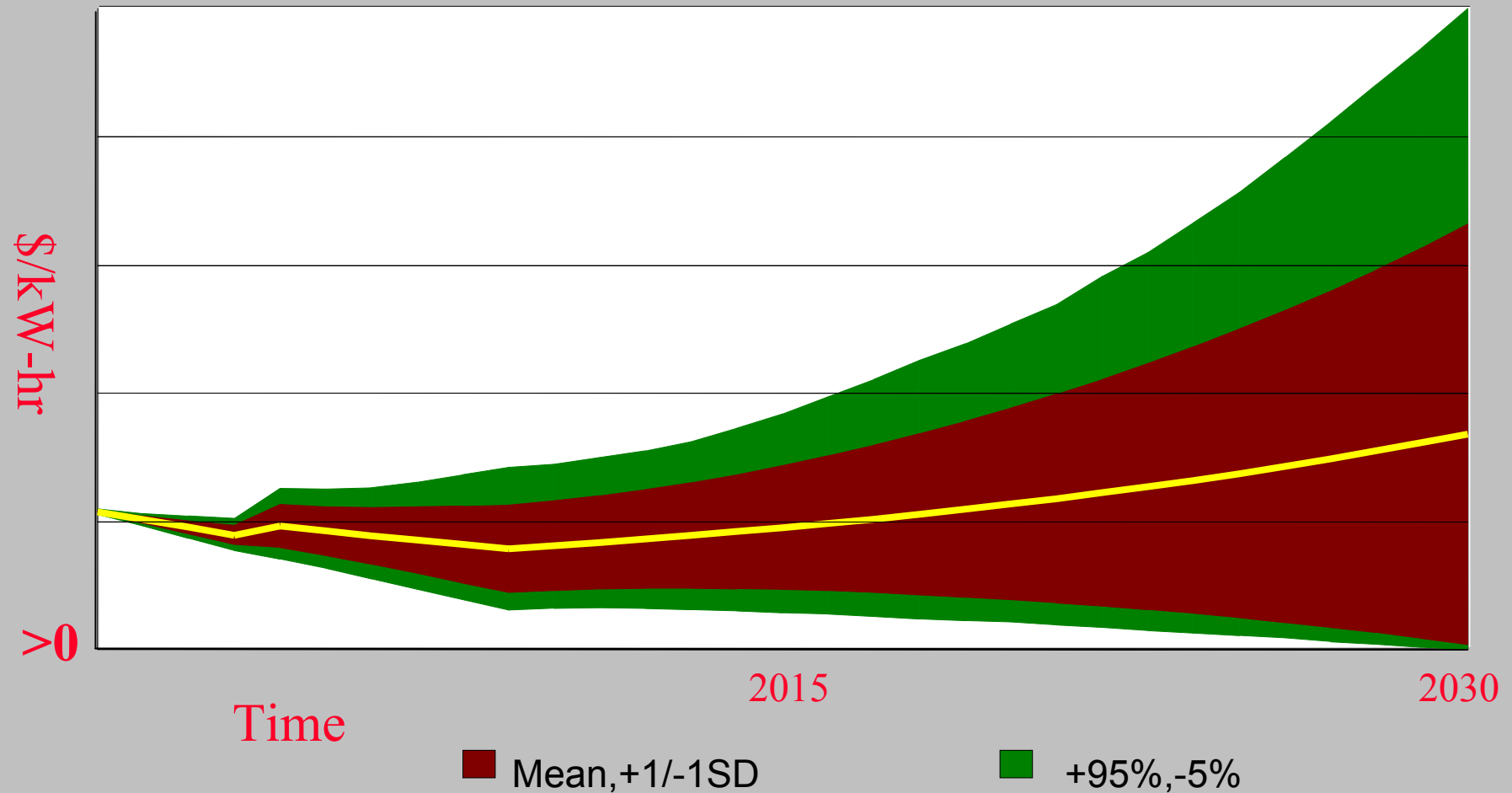
LSC Electrical Demand Load Duration Curve



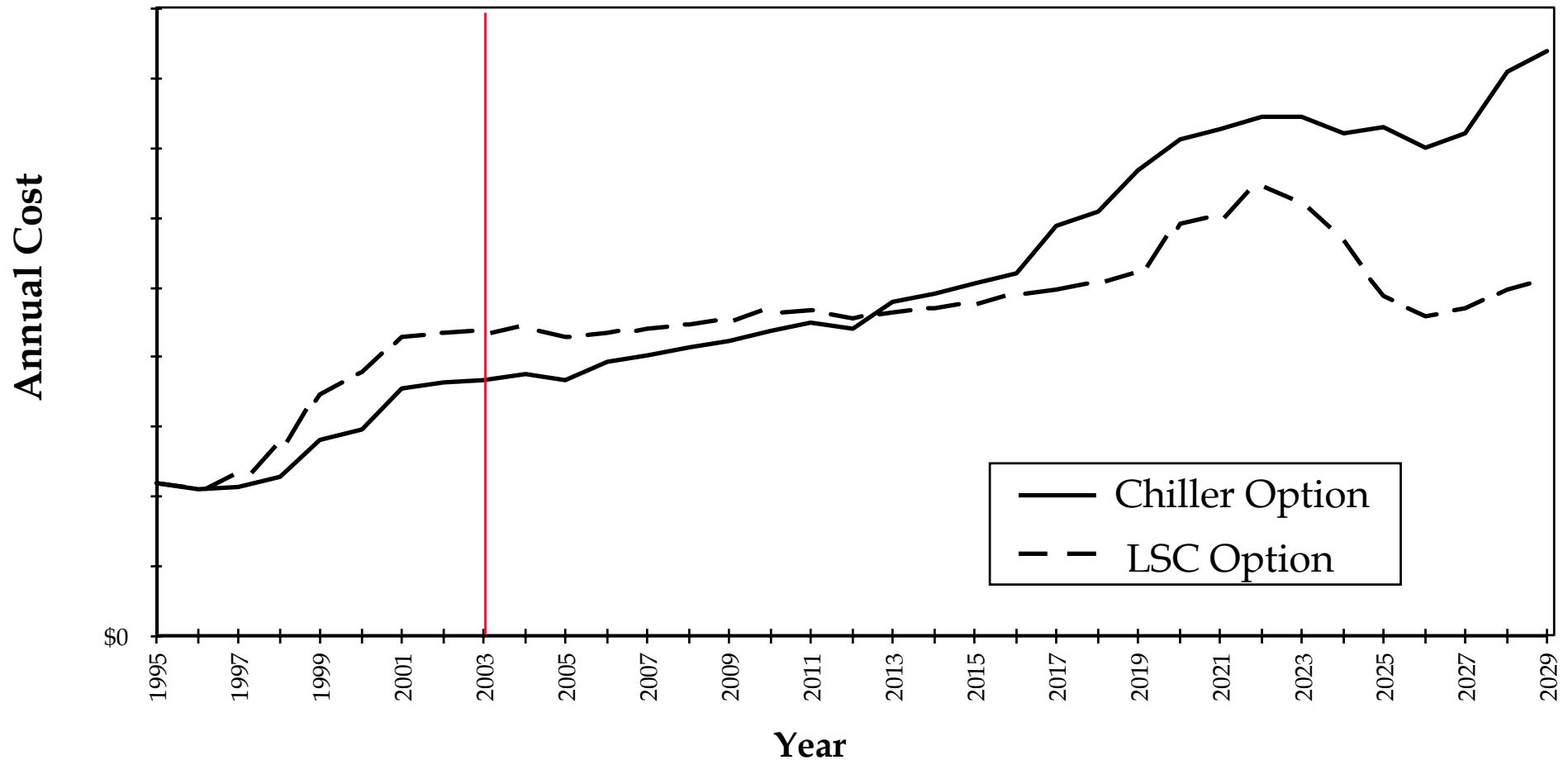
Economic Uncertainty Analysis

- subjective probability of future events and costs
 - construction costs
 - electric rates
- spreadsheet add-on for Monte Carlo simulation
- Net Present Value probability distributions

Forecast “Constant \$” Electric Rates

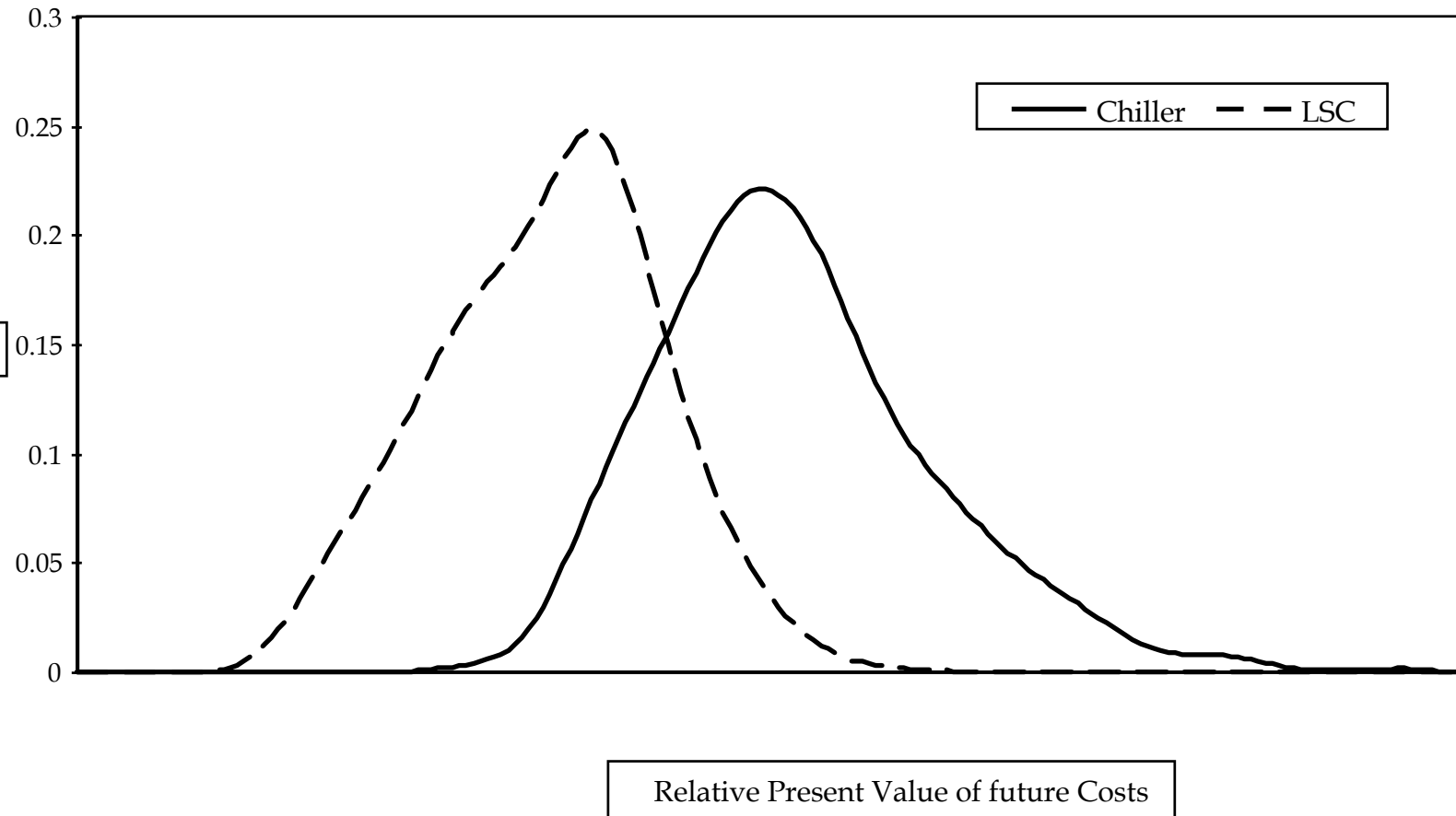


Annual Cost Comparison



Risk Analysis - Present Value Distributions

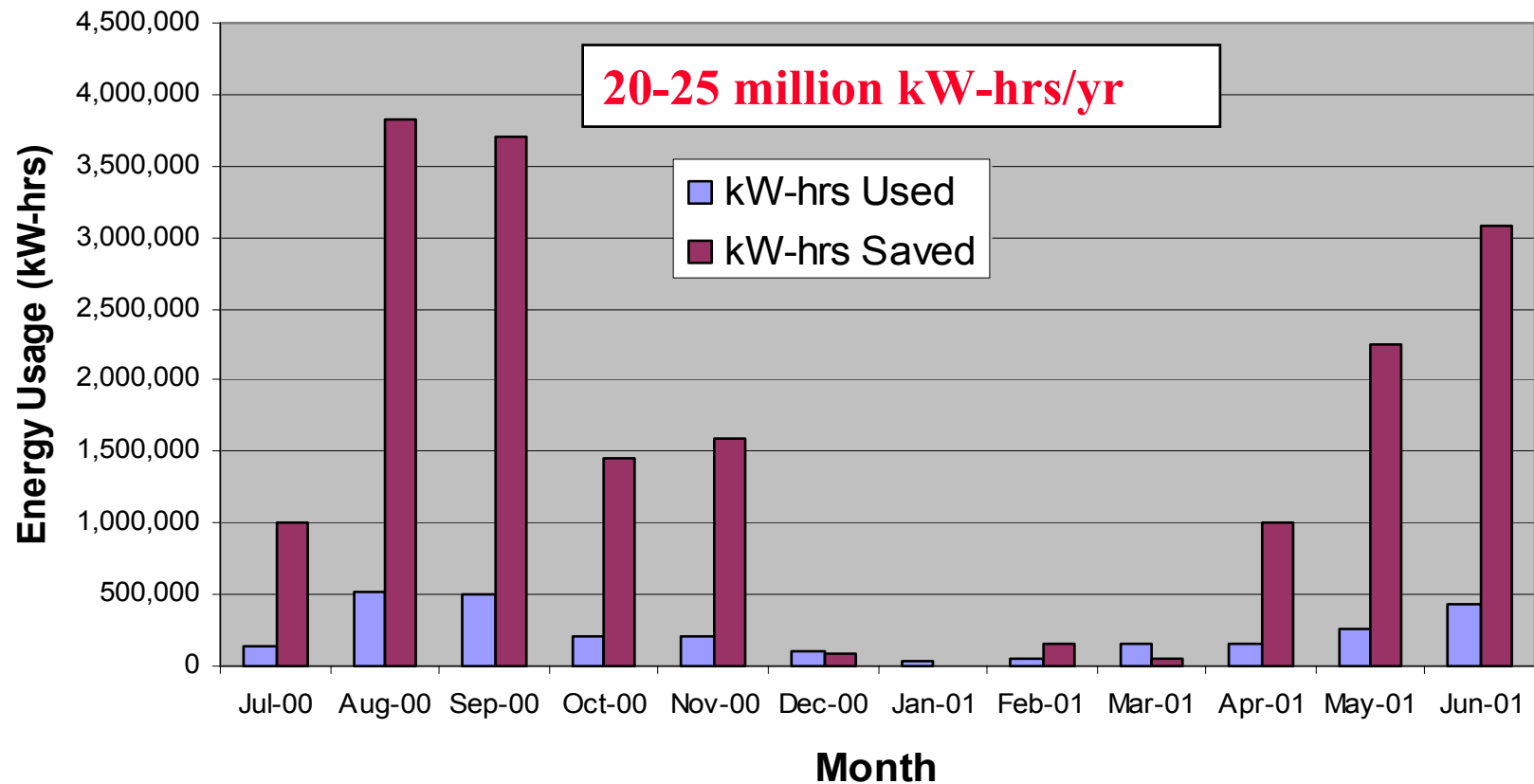
LSC vs. Chillers



Lake Source Cooling

Actual Monthly Energy Savings

LSC Monthly kW-hrs



Summary

- ***BENEFITS:***
 - Decrease in fossil fuel consumption using renewable resource
 - reduces air pollution, acid rain, global warming
 - 87% energy savings
 - Accelerate phase out of CFC refrigerants
 - savings of \$1.75 million for community
 - employment and purchase of supplies during construction of \$22 million
 - simplicity and long term payback for Cornell
 - 100 year design life, over twice chillers

Questions & Answers

